Start-Ups: Unlocking Ambition
It is a privilege to have been asked to be the guest editor of *Science Scotland* for a second time. I have to thank Peter Barr who does all the hard work of interviewing, writing and editing the magazine. I have very much enjoyed working with him. After the last edition went to press, we looked at each other and realised there was so much going on that we should do it again. And this is the result.

I hope you will agree that the diversity of businesses and people covered is inspiring and a testament to what we had earlier found; that there is a vibrant and supportive start-up culture in Scotland – and that the RSE is very much part of that. All the young entrepreneurs interviewed have been part of the RSE’s Unlocking Ambition programme, with individuals coming from countries all over the world – including Estonia, Lithuania, Nigeria, Malta, India and Iran – to take advantage of the opportunities available to them in Scotland.

My experience in early-stage investing has taught me, as is the case in many walks of life, that there is much erroneous conventional wisdom which is often challenged by the facts and it is therefore important to take note of expert research. As Paul Hopkins’ thought-provoking article shows, we cannot rest on our laurels. The start-up thrust tends to be geographically centralised and the rate of business births is, in fact, falling. Furthermore, not enough start-ups are making it to the scale-up stage of turning over £4–10 million. There are, of course, examples of start-ups scaling to substantial success in Scotland, but not enough to create the growth we need in our economy.

It is to be hoped, therefore, that the recent creation of the Scottish National Investment Bank will lead to a better understanding of the challenges of growing businesses in Scotland and the introduction of policies and initiatives to improve and build on success.

*John Waddell FRSE*

...there is a vibrant and supportive start-up culture in Scotland – and the RSE is very much part of that.

*John Waddell is one of the most experienced early-stage investment managers in Scotland and was the CEO of Archangel Investors Ltd from 2005 to 2015.*
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SCIENCE SCOTLAND Issue 23 PAGE 3
The importance of start-ups and business creation to economic growth is well established. Without new firms, there is less competition and fewer new disruptive companies driving job creation at the local, regional and national level.\(^1\)

Successful start-ups also often lead to the creation of more mid-sized businesses (MSBs), and this is important because MSBs disproportionately contribute to growth – they are more innovative, more productive and more likely to export.

Recent analysis by the Hunter Centre for Entrepreneurship at the University of Strathclyde reaffirmed the strong performance of Scotland’s start-ups.\(^2\) But what is less understood is how business creation is spread across Scotland and relates to existing business populations.

This is what my research for Scottish Enterprise set out to explore, and the conclusions not only highlight the importance of start-ups to economic prosperity, but also have important implications for policy makers in their bid to achieve sustainable economic growth with opportunities for everyone – not only in the cities but across the whole country.\(^3\)

\(^1\) Nesta (2013) The Vital 6%.
\(^2\) An update of the Global Entrepreneurship Development Index, Strathclyde University (2017)
\(^3\) Scotland’s Economic Strategy (2015)

After strong growth from 2010 to 2013, the business birth rate in Scotland has plateaued, allowing the death rate to catch up. As a result, from a net birth rate (births minus deaths) of 6,690 new businesses in 2013, the net growth in 2017 was 1,225. And this trend is likely to lead to a weakening of the pipeline of early-stage growth potential companies in years to come.
Dr Paul Hopkins

"...we need to prioritise business creation and rethink our priorities to create more opportunities beyond cities..."

Key conclusions:

1. While Scotland’s net creation of new businesses (business births minus business deaths) has grown since 2010, the rate of growth declined from 2015 across 26 of 32 local authorities compared to 2012–14.

2. Scotland is under-performing compared to other UK regions, and is ranked in the third quartile amongst UK regions for net business creation as a percentage of its business base. To move into the top quartile would have required the creation of an additional 8,059 businesses from 2010.

3. Creation of new businesses across Scotland is highly uneven. The highest growth relative to the business population is in and around the core cities – in Edinburgh, West Lothian, Aberdeen and around (but not within) Glasgow. Growth is weakest in rural and remote areas. So not only are urban areas producing more new businesses, they are also producing more relative to their existing business population – pulling away from the south of Scotland, Ayrshire, the Highlands and parts of the Tay Cities. In this regard, Scotland’s economy is not becoming more inclusive – quite the opposite.

4. As these areas fall behind, there is a growing reliance on the cities to drive the national economy, and the evidence shows that the performance across cities is mixed. Edinburgh is the epicentre of new business creation, and despite seeing a 14% decline in new businesses from 2015–17 compared to 2012–14 (largely caused by a decline in oil & gas), Aberdeen is also a leader in business creation. However, Glasgow City underperforms relative to its business base in new firm creation, ranking in the third quartile, along with Dundee, while Highland (incorporating Inverness) is in the bottom quartile. A more balanced economy would have new business creation distributed more evenly throughout the whole country, so that any decline – as seen in Aberdeen or the ‘underperformance’ of Glasgow – would have less impact at the national level.

The overall sluggish growth in business creation should be a concern, but perhaps the biggest worry is that some Scottish regions are falling behind. If the pattern observed since 2010 continues, the disparities in current and future economic performance across regions is likely to increase, not only weakening overall growth but also draining talent away to the cities, thus increasing the imbalance.

Understanding these trends in new business creation is only one part of the story, however. Further work is underway which will build full growth pictures for every region – from business creation, through achieving and sustaining growth to become high-growth companies, to ultimately becoming MSBs.\(^4\) This is important to understand, because in addition to new business creation rates, emerging evidence suggests that after strong start-up performance, achieving and sustaining growth amongst companies in Scotland with a turnover of about £4 million onwards (to about £10 million) starts to slow, creating a growth bottleneck.\(^5\) Building a full regional view will allow the development of locally tailored responses to tackle challenges like these where they occur, whilst maximising opportunities – all reflecting local circumstances.

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\(^4\) mid-sized businesses are companies which disproportionately contribute to economic growth, and are more productive, inclusive and innovative.

\(^5\) Enterprise and Skills Board Strategic Plan, Scottish Government (2018), p.30
A slowdown in business creation will limit the opportunities to increase the numbers of Scottish high-growth firms and MSBs, which are integral to national growth. In fact, early analysis of the latest MSB data by region suggests that many of the trends observed in start-ups are well entrenched, with some regions clearly lagging at both the mid-sized level as well as in new business creation, whilst others (such as Edinburgh, West Lothian, Fife and Aberdeen) accelerate their growth. In addition, at the mid-sized level, the performance of foreign-owned MSBs in Scotland is outpacing their Scottish counterparts.

This represents a significant challenge for policy makers who, over recent years at the UK and Scotland level, have been driven by the needs and desires of the cities. Whilst instruments such as City Deals have recognised the importance of tailoring support to individual locations, this has contributed to an imbalanced growth picture, heavily dependent on cities at the expense of rural areas and towns, as these (as well as other) data show.

There is a lot of talk about inclusive growth – and with good reason. However, the data suggest that a more substantial shift in focus is needed to deliver this, turning prevailing policy thinking away from a narrow focus and onto a wider economic development standpoint.

There will be many ways to achieve this, but one of the most important is to equip individuals with the skills and confidence to create and grow new businesses, wherever in Scotland they are.

To increase the number of high-growth companies and MSBs, we need to prioritise business creation and rethink our priorities to create more opportunities beyond cities and achieve the Government’s objective of sustainable and more inclusive economic growth for all.

The full report is available at www.evaluationsonline.org.uk/evaluations/Search.do?ui=basic&action=showPromoted&id=685

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**UNLOCKING AMBITION**

RSE ENTERPRISE FELLOWSHIP PROGRAMME

All the start-ups featured in this issue of Science Scotland are part of an initiative called the **Unlocking Ambition Challenge** set up by the Scottish Government in 2018. The programme is designed to support highly ambitious entrepreneurs chosen for their individual potential, the quality of their ideas and the contribution they can make to the Scottish economy and wider society.

The start-ups are supported by the Royal Society of Edinburgh (RSE) and Scottish Enterprise, and the RSE is working with 20 entrepreneurs – each hosted by a Scottish University or Research Institute – as an extension of the RSE Enterprise Fellowship programme.

The 20 RSE Unlocking Ambition Enterprise Fellows were selected from a pool of 115 applicants, 45 of whom were shortlisted for interview by a selection committee made up from Fellows of the RSE, business advisors and trainers, and successful entrepreneurs.

Each Fellow receives up to £50,000 maintenance grant, plus a further £20,000 business support fund, to enable them to work full-time on developing their business idea and establishing their start-up. They also receive expert training in entrepreneurship, a dedicated mentor to support them throughout the programme and access to professional, financial and entrepreneurial networks, including the GlobalScot network, the Scottish Investment Bank, Scotland House, Entrepreneurial Scotland and the RSE Entrepreneurs’ Club.
Scotland may be famous for its midges, but a scientist from Malta may soon put a completely different insect on the map – and provide a very different source of protein which could change the feeding habits of livestock and fish farms...

Thomas Farrugia first started thinking about the potential of insects when he ate some creepy-crawlies from a street stall in Antwerp (no pun intended) in 2011. Four years later in Bristol, he came across an article which posed the question, “Why not eat insects?” Intrigued by the idea of insects becoming a main source of protein, he also started learning how environmentally friendly and versatile insect-based products could be, and the scientist in him began morphing into an entrepreneur.

You could say that is when he caught the bug, but a lot has happened since then and Farrugia is now the managing director of a company called Beta-Bugs, seeking to transform the way agribusiness functions by making a new generation of insects a critical – and more sustainable – part of the agricultural food chain. As the company grows, it also aims to play a major role in the bioeconomy by turning its new breed of insects (black soldier flies) into fuel and high-value biomaterials, taking advantage of the fact that you can breed the bugs to weaken or strengthen various genetic traits – e.g., so they provide more Omega-3 or the type of fatty acids good for biofuel.

The challenge for Farrugia is not just to develop the technology (increasing genetic diversity, then selecting the insects for breeding the next generation) and market his new and improved breeds of bugs, but to cope with the ‘chicken and egg’ problem faced by the industry: “Setting up an insect farm requires a big capex (capital expenditure) investment,” he explains, “and the market is not yet mature. Insect farmers will have to scale up operations to meet the demands of a growing feed industry, but if we can offer them new breeds which increase productivity by 50%, then we’re in business.”
Despite the competition from conventional sources of protein, investment in insect farms grows every year...

The benefits of insect protein are now well established, in aquaculture and for feeding chickens, for example, but pricing is still a big issue. Fishmeal currently costs about £1,000 per ton and soy protein concentrate £600–700 per ton, while insect protein is 2–3 times more expensive than fishmeal. It is only when economies of scale kick in that prices will become much more competitive, enabling insect protein to compete head-on with soy.

The target of the insect protein industry in Europe is production of a million tons per year by 2024, and that means setting up about 100 new farms, each producing 3,000–10,000 tons a year. “In this industry, 500 tons is nothing, but to get the business going, we need a few early adopters,” says Farrugia, referring to “adventurous” black soldier fly producers who want to try new breeds. Despite the competition from conventional sources of protein, however, investment in insect farms grows every year, with some companies around the world committing £60–100 million for new facilities. Other smaller farms are also being built, creating a virtuous circle of waste, bugs and livestock, and even though they’re only a fraction of the market today, they are tipped to be much more important in future.

Despite the challenges, Farrugia is confident. “Better bugs will be the crops of the future, producing animal feed, food and fuel and driving the sustainable bioeconomy,” he says. “The insect industry has huge potential, both environmentally and economically, and the challenge is to optimise the insects for industrial use, to make them easier to farm and become more efficient sources of protein. We’re taking advantage of tried and tested bio-techniques used in plant and animal breeding – in effect, creating the genetic software (breeds) needed to drive the agricultural hardware (insect farms).”

“Breeding is the scalable bit in the animal,” Farrugia explains. “Insect breeds have not been optimised yet, for feed, food or fuel, but by accelerating evolution and increasing genetic diversity, we can double productivity within the next 5–10 years.” And the new “genetic library” will optimise key factors such as growth rate, protein content, fat composition and temperature tolerance, “to increase revenue, efficiency, performance and quality.”
From Malta to Scotland

As he revealed to last year’s annual Falling Walls Foundation international forum for science-based start-ups, Farrugia’s grandfather was a fisherman in Malta, and the young man was always impressed by the size of the fish that his grandfather caught, as well as the number of small fish which farms used for animal feed – a lesson he’s never forgotten.

After gaining his BSc in Chemistry at the University of Malta in 2012, Farrugia went on to do his Master’s at Imperial College London, “using computational techniques and solid-state physics to conduct research in graphene nanomaterials.” Next, he did his PhD in Chemistry at the University of Bristol, focusing on “producing enzymatically active thin films,” before he got involved with an organisation called Deep Science Ventures in 2017 and set up Beta-Bugs later that year.

The battle of ideas

Farrugia’s experience with Deep Science Ventures has had a big impact on his business as well as his thinking. The investors focus on scalable technology and science-driven companies, and invite people such as Farrugia (mostly PhDs) who are specialists in various branches of science to throw ideas for new ventures into the ring to see which ones will win in the battle for money.

Three months later, Farrugia emerged from this “battle of ideas” with a £50,000 investment (in return for equity); but more than anything he also realised that insects were not just the future of the bioeconomy but also the business for him. Despite his early interest in creating his own insect farm, however, his early investors advised him against this because it would cost too much money. “The idea was to see where we could make the biggest difference in the value chain,” says Farrugia, “and high-performance breeds were the answer.”

The next step was to build a breeding system (the first insectary was small enough to operate in somebody’s kitchen), and begin to breed new generations of insects, analysing each new breed for useful traits (e.g., faster growth and larger size) which could be amplified in future generations by careful selection. At this stage, Beta-Bugs recruited its first employee, George Chanarin, who helped design the first insectary.

In early 2017, Farrugia set up a new insectary in Unit DX, a science incubator based in Bristol set up by Dr Harry Destecroix, co-founder of Ziylo – a spin-out purchased by Novo Nordisk for £800 million last year. This was soon followed by a move to Rothamsted Research in Hertfordshire to scale up the colony, keeping the insects in a room about 12 feet by 12 feet, insulated and kept at a temperature of 27 degrees Centigrade.
Soon afterwards, Farrugia had to move the insectary out of Rothamsted, following complaints about high levels of ammonia messing up nearby experiments, including one with pheromones. To house his bugs, he bought a 20-foot container for £200 and cycled around in the area asking local farmers for somewhere to park it, before he moved it back to Rothamsted, spending more on haulage than the actual container itself.

Around this time, Farrugia met John Mackenzie, CEO of the Roslin Innovation Centre near Edinburgh, and Charles Vander Broek of the Knowledge Transfer Network (KTN), who both encouraged him to apply for RSE funding. “It made sense to talk to the people at Roslin,” Farrugia explains, “because it is a centre of excellence for animal breeding.” And now that Beta-Bugs is being hosted by the Roslin Innovation Centre, Farrugia is planning to move all his kit up to Scotland, at the same time as recruiting a Chair for the Board and engaging with both insect farms and end users.

As well as learning from the scientists at Roslin, Farrugia is keen to take advantage of the specialist knowledge of insects built up by researchers with completely different motives – running projects designed to eliminate negative traits. “Instead of trying to kill them,” Farrugia says, “we’re trying to breed better bugs.” Nutritional researchers will also help Beta-Bugs sharpen its knowledge, including scientists in the Institute of Aquaculture at the University of Stirling.

Why invest in insects?

Farrugia believes that insect protein has enormous investment potential, and also thinks that breeding better bugs and selling larvae to farmers is where the returns will be greatest: “Insect protein is a fast-growing market and we are focused on the scalable part of the value chain, creating defensible assets, rather than getting involved in the commodity market or setting up our own fly farms.”

The unique selling point of Beta-Bugs, according to Farrugia, is “using plant and animal breeding techniques to create a genetic library of breeds which can be developed in parallel.”

Unlike livestock, new generations of insects can be bred in a matter of weeks compared to several years – and Beta-Bugs will be able to protect its own special breeds, “through a combination of biological and commercial approaches.”

Beta-Bugs has also created an innovative business model, starting with a fixed fee, selling larvae to farms, then moving on to a fixed fee plus royalty model. For example, when productivity improves by 50%, Beta-Bugs will earn a commission, based on the increase. Once total production reaches millions of tons, the opportunities for higher earnings will soar.

Beta-Bugs has already attracted some funding and plans to seek first-round investment at the end of 2019, focusing meanwhile on building its know-how and industry networks. So far, in addition to the £50,000 investment from Deep Science Ventures, the company has won funding from Innovate UK and the SME Instrument Phase 1 competition, worth a total of £95,000, as well as support from the RSE Unlocking Ambition programme – see page 6 – which included hosting at the Roslin Innovation Centre. “Winning the RSE Fellowship was a game-changing moment,” says Farrugia, “which will help us in the drive to commercialisation.”

Like most other start-ups, investing in insects is not without its element of risk, but Farrugia is confident his business plan has what it takes to succeed. “We’re building a new company in a market which is only just beginning to develop,” he says. “That means we are taking a risk on a risk, but we are confident that our approach is different enough to succeed.”
**What’s next?**

Insects are already being sold in supermarkets, but that’s only one market stream. Livestock and fish feed producers promise to be major buyers as they diversify their sources of protein and get into insects, whilst livestock farms and fish farms will also be major end users, buying feed containing insect protein. Fuel and biomaterials will also become more important through time. Because they want to stress their credentials as sustainable suppliers of healthy nutrition, retailers will also be interested, says Farrugia, selling insect-fed produce such as chicken and fish. Governments are also beginning to express greater interest in insects for food and for fuel, because it will reduce waste, increase sustainability and strengthen domestic protein production (the domestic supply chain).

“Insect farms still have a long way to go, but as the industry gathers momentum over the next five years, we’ll scale up very rapidly,” Farrugia says.

If all goes well, Farrugia and Beta-Bugs may find themselves the target of a buy-out a few years from now, with feed manufacturers, insect farms and livestock producers the obvious suitors. But Farrugia has other ideas: instead of being bought out by a large corporation, why shouldn’t Beta-Bugs become a global player in its own right, along the way acquiring other companies in the same sector?

No matter what Beta-Bugs does next, however, Farrugia is clear about one thing. “It’s all about food on our plates,” he concludes.

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**The buzz about bugs**

With the world’s population expected to reach at least nine billion people by 2050, and consumption of protein increasing by 50% in the last 40 years, demand for animal protein will soon outstrip supply, unless science comes to the rescue. And alternative sources of protein such as insects (1,900 edible species) could be the environmentally-friendly solution – not just for their high nutritional content (fats and proteins) but also as a source of vitamins and minerals. Insects also offer more efficient food conversion, using up less water and land, and produce lower greenhouse gas emissions than traditional livestock.

The market for animal feed is another major source of future revenue, currently worth an estimated $400 billion a year, and the “insects for feed” market is expected to be worth $1 billion a year by 2022.
Throw away your garden tools and old-fashioned mowers – the robots are coming. The lawncare and grass-cutting market is worth an estimated $24 billion a year, with domestic users, public parks and golf courses spending vast amounts of money to keep up appearances. Robot mowers have been used for years to automate the process on residential lawns, but until now have been very expensive and far from efficient for larger terrains, and this is where Kingdom Technologies sees a huge gap in the market, by developing a new kind of intelligent robot for commercial lawns which cuts the grass just like a human – without getting backache or ever complaining...

Joan Kangro, the CEO and founder of Kingdom Technologies, likes pushing himself to the limits, and his latest venture to develop a lawnmower robot and sell it all over the world promises to “cut it” in more ways than one.

Always keen to explore new ideas, Kangro has been involved in various projects, including developing an autonomous drone, building the electronics for a formula racing car and designing a number of autonomous rovers. He also spent a year at the Italian Institute of Technology in Genoa (2016–2017), while he wrote his Master’s Thesis, working on “one of the most advanced humanoid robots in the world,” called iCub, specialising in the artificial skin for the robot, and publishing three academic papers in the process.

Four years ago, while still a student at the University of Glasgow, where he graduated last year with a Master of Engineering degree, specialising in mechatronics, Kangro was co-founder of a company called Gym Diary, managing a team of five people to develop a fitness app, in partnership with a physiotherapist friend. “We thought it was a good idea to digitise the fitness diaries people use to monitor their progress,” says Kangro, “and even though there were already a few competitors, we thought we could do it much better.”

Thirty-thousand downloads later, Kangro and his business partner realised the app may not work out as well as they hoped. “We shipped it without having spoken to enough users, and then discovered more than 30 rival companies were developing similar products.”
Retailers know what their customers want, so every time I spoke to one of them, it was like speaking to thousands of customers at the same time.

Maybe Kangro should have talked to another RSE Unlocking Ambition Fellow, Tadas Labudis, who has developed a solution to automate analysis of customer feedback, so companies can make better product decisions (see story on page 20), but at that time he was moving on to other new projects, including the lawnmower robot – determined not to make the same mistakes again.

Before finalising the product design of his lawnmower robot, due for its official launch within the next few months, Kangro spoke to numerous homeowners, retailers, golf courses and city councils in various countries to research his idea, asking them all what their customers ask for and don’t like in similar products. “If I am going to work 70 hours a week to develop the product, I want it to be something that people will buy,” he explains. “Retailers know what their customers want, so every time I spoke to one of them, it was like speaking to thousands of customers at the same time.”

The robot comes to life

The new lawnmower robot is designed to cut all sorts of lawns, including residential, but Kangro is focusing initially on big commercial users such as golf courses and public parks. Kangro says his new design “mows like a human,” and is “ten times more efficient than existing designs,” when you calculate the cost of cutting every square metre of grass. Current robot mowers still have lots of problems, says Kangro, including limited radius and a tendency to move around at random, along with high prices ($15–20,000 for a large-terrain mower). In addition, the current generation of robots needs boundary cables installed in the soil (which constantly draw current and often have to be re-installed), can’t cut the edges of the lawn or cut close up to obstacles and use reactive safety measures that have proven dangerous for children and pets. “Old-school” manual lawnmowers pose even bigger problems, says Kangro, because they are expensive for commercial customers, time-consuming for homeowners and potentially dangerous (69 Americans were killed last year mowing their lawns). Manual mowers also leave behind a large carbon footprint – according to the Environmental Protection Agency (EPA), an estimated 5% of US air pollution comes from petrol-driven mowers.

“Robot mowers have been around for about 25 years, but it took a while to make something people would buy,” says Kangro. In Scandinavia and the Baltic countries, a large percentage of homeowners have already adopted the robots, but he believes that his design will capture business from commercial clients because it will “significantly” cut the cost of lawn care and provide a better mowing quality and greater safety, and eliminate the need for a boundary cable.
The RSE experience

Joan Kangro has not only been awarded £45,000 in funding, but will also receive business training. “Having been involved in setting up another new business before, I don’t want to make all the common mistakes made by start-ups,” he says. His mentor is not only helping with general business advice, but is also highly experienced in design for manufacturing and the supply chain, which Kangro thinks will be invaluable as he drives his company forward.

The safety features of the new design include using sensors to detect nearby humans – the mower beeps then stops as soon as someone gets too close. And if anybody tries to push their hands underneath, the blades are already switched off.

The three-blade cutting mechanism means you can go to the edge of the lawn and mow as close as possible to obstacles, instead of using a manual mower to finish the job. “One blade is simply not good enough,” Kangro declares. “So you can throw your old mowers away!”

Computer vision and intelligent software also help the mower know what’s grass and not grass, using machine learning and pattern recognition (colour and texture), and this is what enables the robot to operate without needing boundary cables to map out the lawn. Kangro demonstrates this using a green hoodie laid on the ground, showing how the mower simply avoids it because it can detect it is the wrong shape and texture, even though the colour is the same.

The unique selling point of Kangro’s design, however, is what he describes as its “human-like navigation” capabilities, enabled by his company’s proprietary solution, which includes positioning, mapping and navigation technology.

Development started two and a half years ago, while Kangro was still studying for his Master’s degree. Kingdom Technologies was incorporated in July last year, about the same time Kangro was awarded his RSE Fellowship. The prototype was ready to demonstrate in February this year, and before the production line swings into action, Kangro will be focusing on design for manufacturing. Kingdom Technologies is planning to apply for a patent for the technology behind the human-like navigation, and also needs to make sure it meets regulatory standards before it is put on the market.

The robot mower is expected to cost about £3,500 when bought in larger numbers by commercial clients, retailing to homeowners for about £4,000. A typical golf course with about 40 hectares of rough and 30 hectares of fairway needs about 15 of his robots, and this would mean a capital outlay of £52,500, plus a fleet management fee of £100 per robot per month.

Will the lawnmower robots take over from humans? “The robot mower operates just like a human, so people can get on with more important jobs,” says Kangro.
**Investment so far**

Since setting up the company, Kangro has won £65,000 in awards (including £45,000 from the RSE). The company has also been accepted onto a Santander Summer Company Incubator Programme and has won a Jay Smith Innovation Award. Kangro is aiming to raise seed round financing later this year to finalise the product design, pilot the first 50 prototype models and start large-scale manufacturing. “With a hardware start-up, your investors want to see your product working in real life,” says Kangro, but he already has letters of intent from retailers and pilots agreed with city councils (including Glasgow and two cities in Estonia) and golf courses.

“I also have a lot of people asking if they can get models to test on their own lawns,” says Kangro. So far, he has been focusing on making presentations, with a view to doing demonstrations later. But once the early users see the potential for savings and the improved efficiency of the design, he is confident orders will follow.

**Future plans?**

Ultimately, Kangro wants to create an ecosystem of smart garden products, with robots not only to cut grass but blow leaves in autumn and clear snow in winter, as well as measure moisture and intelligently manage irrigation. Some robots could even act as security guards in the garden.

Kangro is not getting carried away by his future ideas, however. “This vision will only be possible,” Kangro makes clear, “if the first product turns out a winner.” Current sales projections are over 700 mowers in 2020, rising to well over 3,000 the following year, so if Kingdom Technologies even comes close to these figures, the plan will be shaping up well.

Even though he is focused on making his lawnmower robot a market success within the next couple of years, and has much more ambitious innovations in mind, Kangro also has an altruistic streak: “My primary field of interest is cutting-edge technology that adds value to society,” he says. But if he wants to help other people and prove his technology works, perhaps he could pilot his “cutting-edge” lawnmower robots with friends and potential investors?
The future of human resources?

Developing software to understand how groups such as disabled people living in Glasgow interact with each other and the wider community may have profound implications for the corporate world, helping multinationals unlock the potential of their workforce and improve productivity – if Colin Campbell and his team have got their sums right...

Maybe social enterprises are becoming more “businesslike”, or the corporate world is becoming more “social,” but Colin Campbell would argue that both sectors have much in common and can certainly learn from each other.

The social enterprise sector is also a significant and fast-expanding part of the economy, as well as doing lots of good for the community. According to the European Commission, not-for-profit organisations now account for about 10% of businesses in Europe, with two million social enterprises employing an estimated 11 million people or 6% of the workforce. And according to Campbell, the Founder and Executive Director of Assist Social Capital (ASC), a new cloud-based analytical tool developed by his company which measures “social capital” in not-for-profit organisations, could have a similar impact in the profit-driven world of multinational business, transforming their corporate structures and how employees work with each other in increasingly collaborative networks.

After 14 years establishing his company in Edinburgh and then developing the software, Campbell is now on the verge of a new phase of business, seeking investment to translate the work he’s been doing in the voluntary sector to the corporate sector. In the process, he also wants to help social enterprises, charities and environmentalists to sharpen their “competitive edge” – articulating what they are trying to do, measuring their impact, raising funds and lobbying for policy changes.

Campbell has always had an interest in the third sector, and when he returned to Scotland after eight years in Spain, where he taught business English, he spent eight years working at Senscot (the Social Entrepreneurs Network Scotland), setting up and supporting peer-support networks for active social entrepreneurs across Scotland. At one time, says Colin, he was probably the “most-connected” person in the sector, active in 23 social enterprise networks (SENs), run by social enterprises for social enterprises, meeting every 6–8 weeks to exchange ideas and learn from each other. Each SEN was conceived as a “chamber of commerce,” based on geography or sector – e.g., health, sport and tourism – and Campbell learned along the way that the main challenge faced by the organisations involved was to demonstrate impact, and that meant gathering and analysing data to make sense of the very different activities of different groups. In simple terms, potential funders want to know why you need money, how you will spend it and whether it was well spent, and if you can evaluate your impact, your story has greater appeal.
As a graduate in chemistry, biology and business management with a passion for progressive social causes and a personal experience of developing social networks, Campbell felt that he had something different to offer the sector – and also recognised the need to take advantage of technology. “A lot of charities and social enterprises were doing brilliant work, but many of the people behind them were just burning out,” he explains, “because of a shortage of funding and human resources.” Having been a fundraiser prior to working for Senscot, Campbell also had first-hand knowledge of the challenges faced by these organisations when it came to demonstrating their impact. “There’s an art to raising funds,” adds Campbell, “but technology also has a major role to play.”

What was needed, says Campbell, was a new benchmarking methodology, based on the principles of understanding social capital (see box). He also recognised the need to translate academic research into practical, easy-to-understand tools which would benefit organisations by telling their stories in terms of real impact.

“It’s all about relationships,” Campbell explains. “Without relationships and collaboration, you can’t deliver benefits. The challenge is to turn crowds into communities, in the knowledge that people and organisations achieve more via networks than through centralisation, by learning from each other and sharing ideas, as well as joining forces to lobby for policy changes. And the social capital generated by collaborative networks is the operating platform of any community, enabling them to add up to more than the sum of their parts.”

The business

Campbell set up ASC in 2004, but monetising its activities was a challenge at that time and the company initially focused on organising an annual conference called the Social Capital World Forum, working with a partner based in Austria. “I would have gone anywhere in the world to pursue this,” says Campbell. In the early days, he also had support from an organisation called Scotland UnLtd, which funded social entrepreneurs, to develop the methodology. One of the first projects ASC worked on was a report for the Scottish Government, focusing on the “return on investment” of social enterprises supported by Scotland UnLtd, so they could improve their operational efficiency and draw up a long-term future strategy.

“At that time, few people were using the phrase social capital,” Campbell explains, “but when I Googled it, I noticed there were two million hits, so I knew there must be something worth exploring.”

For Campbell, quick to spot an opportunity for innovation and entrepreneurship, the first few years were not a walk in the park, but along the way he learned a lot of lessons. Early on, he also saw a chance to build a bridge between academic research and the practical challenges faced by social enterprises.

What is social capital?

The term “social capital” has been in use for decades, but has become more popular in recent years. It is defined by the OECD as “networks with shared norms, values and understandings that facilitate co-operation within or among groups.”

Social capital has also been divided into three main categories:

1. **Bonds** – connections to people based on a sense of common identity (“people like us”) such as family, close friends or members of the same clubs.

2. **Bridges** – e.g., connections to more distant friends, colleagues and associates outside of our immediate circles.

3. **Links** – vertical connections to people or groups with financial or political influence.
The technology

The concept behind Campbell’s software revolves around what he calls “the six indicators,” which he compares to strands of DNA – all of us have a unique blend of characteristics which makes us individual, just like any organisation.

According to Campbell, social capital is divided into “structural social capital” and “cognitive social capital.” The structural aspect is all about bonds, links and bridges (see sidebar on previous page), whilst the cognitive aspect is all about trust, reciprocity and shared understanding. And when you analyse these characteristics, you gain insights into any situation where people collaborate as part of networks.

By analysing the Social Enterprise Networks1, to “make the intangible visible,” ASC has also found that roughly 55% of social capital comes from the bonds between peer groups, 29% from the bridges with outside organisations and 16% from the links formed with policy makers and funders. And by being part of an SEN, individual organisations have opportunities to increase their connectivity by up to 900%, says Campbell – and this is how they leverage their social capital.

Campbell is quick to point out what the ultimate aim is: “We don't change what they do, but we do provide evidence which they can use to benefit the organisation – e.g., to raise funds or argue for policy changes.” Nowadays, no matter how important you may think your cause is, it’s accountants who look at the numbers, says Campbell, but you also have to make your data easy to understand – using visual aids, for example.

The Glasgow Disability Alliance (GDA) is a good example of the ASC methodology in action, and a model of how an organisation can change our communities for the better through the power of networks to improve its effectiveness and access new investment. With 3,000 members, the challenge for GDA is to raise funds by explaining its purpose and what it is doing. By studying the GDA network, ASC found that the connections between the disabled people who make up its membership were on a par with most adults in the UK, despite the extra barriers they normally face – with an average of 150 connections for each of the disabled people surveyed, including more than ten close connections. There are strong bonds between people and very high levels of trust, and this has empowered the members to lobby for policy changes, using methods that Campbell describes as “hard-hitting but done with great humour.” When raising funds, he adds, you have to be more innovative than ever, and by joining their forces, the GDA members have come up with brilliant ideas.

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Seeking investment

ASC is now at the stage where it’s seeking investment. “We are becoming an investible organisation, with one solution for the social enterprise and corporate sectors,” says Campbell, who believes it is important to remain independent to develop the software, taking advantage of the latest advances in machine learning and Artificial Intelligence. He also wants to work with people who share the company’s interest in using data for good – as well as for profit – to unlock the potential of employees in various sectors. The company structure has also evolved to prepare for its next phase of growth, changing its status from a charitable company to a community interest company (CIC) limited by guarantee, which is now spinning out the intellectual property (IP) for the evaluation platform into a limited company.

“We have proved the methodology works,” says Campbell. “Our challenge is to find innovative leaders in different sectors who want to unlock the potential in their workplaces through the collaborative advantage and agile working culture we can help them harness. We also want to scale up our business.” The company’s development has also been helped by support from Edinburgh Innovation and the recent RSE Enterprise Fellowship which will fund Campbell for the next year. “The human capital sector is currently worth about $30 billion,” says Campbell, “and also growing 10% a year. That is where we see our long-term future.”

Social capital is growing in importance as a way to analyse workforce performance and help create collaborative networks, and Campbell agrees with the idea that “without social capital, we can’t explain how the economy works.” One study recently claimed that a bank had improved its performance by 13% by analysing its networks to increase engagement and optimise the way that its employees worked together. In Campbell’s view, it’s all about the quality of networks, and that is where the “DNA” of social capital gives organisations the edge.

In the digital world, the trend is now towards more social, fluid and collaborative practices at work, so if ASC delivers results for the likes of Wester Ross Biosphere and GDA, why can’t it do the same for any multinational business where understanding social capital could be the future of human resources?

...without social capital, we can’t explain how the economy works.
Making sense of customer feedback

Successful companies not only make money by keeping their customers happy but also by listening to them, to understand their needs and find out what they think of their product or service – but if they’re faced with zillions of comments, how do they get “actionable insights” from the noise? Based in Edinburgh and hosted by the University of Glasgow, Prodsight has developed a software solution to automate analysis of customer data, so companies can make sense of feedback and make better business decisions...

Since he came to Scotland from his native Lithuania in 2008, Tadas Labudis has never stopped working – or learning. After two years at Glasgow Kelvin College, where he studied for an HNC in Business, Labudis graduated with an MA in Business & Management at the University of Glasgow, and while he was still studying got involved in a couple of projects – establishing an online drum store, creating a social network for students and setting up an award-winning personalised event discovery platform called Eventhread.

For Labudis, this experience was not only useful in learning the basics of business, but also gave him valuable insights into product development which helped him in his first jobs after graduating five years ago – and when he went on to found Prodsight in September 2017.

“When we developed these websites, we were blind to the needs of our users,” Labudis explains. “We did no research and never asked our customers what they thought of what we were doing. We were totally focused on pushing solutions and assumed far too much about user requirements.”
At first, it was impossible to make sense of the noise – the anecdotal data based on ‘gut’ feelings – but gradually patterns began to emerge.

In his first jobs after leaving university, Labudis continued to learn about product development in the commercial environment. His job at Kotikan was helping to develop mobile apps, and this involved conducting interviews with customers. At Yavi, he led a team developing a mobile messaging app for high-street food and retail chains, and also got involved in user research sessions and usability testing. As he processed the data from these conversations, he started thinking more about customer feedback and spotted a gap in the market – and was so inspired he quit his job soon afterwards to start his own business.

Labudis explains: “We were trying to listen to what users were saying, and there were hundreds of support tickets – full of requests and reports about bugs in the software, etc. It was easy to be overwhelmed by the comments but we knew there were valuable insights to gain, so I created a spreadsheet to start analysing the data. At first, it was impossible to make sense of the noise – the anecdotal data based on ‘gut’ feelings – but gradually patterns began to emerge.”

Building in-house tools to analyse the data would have been the logical next step, but would have been a “detour” for Labudis in his day job, developing software. Some big developers do build their own analytical tools, but smaller firms do not have the resources to do so because it is a relatively small part of their core business. And when Labudis saw the opportunities out there, he decided to go it alone by setting up Prodsight, with a mission to develop a product which would “help companies make data-driven product development decisions,” by identifying usability issues, software bugs and feature requests, using Artificial Intelligence to turn the raw customer data into meaningful insights.

Having been a product manager himself, Labudis started asking other people what they thought about his idea, and started building confidence in what he was aiming to do. He also wanted to establish if analysis of customer feedback was a problem for specific types of companies or a much broader issue for all firms. “It’s good to be niche,” says Labudis, “because it helps you focus. But to build a sustainable business, you need a much wider appeal.”

First subscribers

Soon after setting up the company in Edinburgh’s CodeBase technology hot-house, Labudis signed his first subscriber, a mid-sized US company with 200 employees, quickly followed by several others, paying $5 to $100 a month. For Labudis, this was not only paying the rent but a learning experience right from the start, with six months of savings to keep the new enterprise going – and a vision to sell to subscribers.

According to Labudis, there are two major problems in product development and customer service, when it comes to making use of feedback. First, as companies scale, the volume of customer feedback increases and they need to hire more support agents to deal with the traffic. By using Prodsight to analyse the conversations, says Labudis, they can identify common customer queries, create self-help material and thus reduce the volume of the traffic as well as the cost.

The second problem is strategic, says Labudis. In a highly competitive landscape, companies are constantly looking for ways to gain a competitive edge through innovation. Prodsight is designed to help identify strategic and tactical opportunities to improve products or services by highlighting customer “pain points” discovered in support conversations.

In addition, says Labudis, about 80% of customer feedback revolves around two or three issues. And as companies grow and become more successful, the further away their original founders and management layers will be from their customer base – and the more they need to find a way to keep in touch with customers.
Prodsight’s simple vision was to automate analysis of customer data, gathered from ‘live’ chat, sell the service to subscribers, then ask them for feedback to improve the product and sell it to even more clients. In other words, Labudis knew the best way to develop his solution was to practice what he preached and do exactly the same as his clients – a total of 90 subscribers within the first year.

Different clients wanted to do different things. For example, some simply wanted to archive their customer data, while others wanted to know exactly what their customers were saying about them and learn how to improve their service or product and prioritise what they were doing. Initially, Labudis had to analyse the data by himself. This may have been a time-consuming process for the entrepreneur, but it has given him invaluable insights into market requirements. “It also proved that if I could automate what I was doing manually and scale up the product, the market potential was huge,” he explains.

Labudis was also delighted to see that his product was already leading to positive outcomes for clients, as they identified problems and solved them.

After four or five months, the prototype solution was able to “crunch thousands of customer conversations,” and Labudis started looking for investors to match his ambition. “To develop the product, I needed to hire the right people,” he says, “and that meant I needed investment.”

**Investment drive**

Labudis had never attempted to raise money before, but in May last year, he was successful in applying for an RSE Unlocking Ambition Fellowship (hosted by the University of Glasgow), and managed to attract his first investors, introduced by Gavin Dutch, his former boss at Kotikan. Labudis was able to prove that his idea was already working and demonstrate he also had the confidence of customers, but next he had to persuade his investors that the product could scale and provide the intelligence needed to analyse vast amounts of customer data, taking advantage of recent advances in natural language processing technology to make sense of the noise.

This first round of investment raised a total of £70,000, on top of the £45,000 from the RSE Fellowship programme. His early backers included a number of prominent angel investors such as Alistair Forbes, Rob Dobson, Judy Wilson and Andrew Barrie, as well as Callum Forsyth, Robin Knox and Paul Walton of SeedHaus. This enabled Labudis to hire two employees – a data scientist and someone who could productise the prototype solution, and help him make his vision a reality.

“To unlock the investment and build up the team, I needed evidence, but before I knew it,” says Labudis, “the investment had snowballed.”

As a solo founder, Labudis is now getting ready for Phase 2 of Prodsight. “I have cracked the first part of the puzzle,” he says, “but now I also have two employees to care for.”
**Future plans**

Prodsight currently focuses on text-based feedback gathered from customer live chat, analysing all the words to find any relevant patterns – inferring structure from the text. Even small companies have thousands of conversations with customers, so to capture that and turn it into useful conclusions is “spectacular,” according to Labudis, who is also being helped by two natural language processing specialists from the University of Glasgow “to refine the conversation analysis processes.” In the future, similar solutions may also analyse telephone-based conversations, using existing voice transcription techniques, but Labudis says that text and live chat will continue to be a more popular option for customers who grew up in the digital age (please see sidebar).

Armed with Version Two of his software, Labudis will now build his customer base and seek to convert his existing subscribers, in the process proving that Prodsight can handle much larger volumes of data, as “the serious business” begins, with subscribers paying up to $600 per month. One key advantage, he explains, is that subscribers can manage the service themselves without needing direct support.

Labudis knows he has to prove the numbers first and show that his model will work, and scalability will also be a critical factor, as he seeks to unlock more investment – the third round of investment is already “well in advance.” Another key part of the marketing strategy will be case studies, identifying companies who focus on customer service or product development who can act as ambassadors and pilot the software.

The market potential is huge, says Labudis: “The customer feedback analysis space is still a relatively young market but it is growing very fast – there are currently some 1.5 million companies across the world using live chat functionality and generating billions of customer conversations.”

The solo founder may have built up his business the hard way by using his own cash as “a runway” to future success, but his vision has always inspired him. “Our product gives you clarity,” Labudis explains, “and is all about keeping your focus in the midst of the customer noise. If you can learn from your customers faster, and connect with them better, and analyse what they are saying and what they require, you can then make much better decisions and prioritise product improvements because you are better informed.”

And if Labudis uses his own clever software to make it more clever, he should be able to achieve the same for Prodsight that he promises subscribers – completing a virtuous circle of self-powered growth.

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**Live chat becomes more popular**

According to a number of researchers, live chat continues to be the preferred way to contact online companies and usage is expected to grow by almost 90% over the next two years. The reason for this rise in popularity is that about 50% of all customers would rather chat with someone online in real time than call up on the phone for support. Another survey found that 42% of online customers prefer to use live chat compared to just 23% opting for email, and 16% choosing social media or forums. In another study, 73% of customers described live chat as “the most satisfying” method to communicate online, while 63% said they were more likely to return to a website that offers live chat.

Despite the mounting evidence, only 9% of online companies use live chat on their website, even though it enables a single customer support person to deal with up to six customers at once, compared to phone and email support, when you can only respond to one customer at a time. In addition, the average response time for emails is 12 hours, and the average response time for social media is ten hours, compared to minutes for live chat. Having to wait for responses is one of the reasons consumers take their business elsewhere, while provision of live chat has even been cited as a main reason customers buy from a website – and thus a major boost to sales and revenue.
The ability to make any process a thousand times faster and ten times cheaper is a big claim to make for any new technology, but RAB-Microfluidics is now busy proving that its intelligent real-time solution for oil condition monitoring (OCM) could revolutionise the way that many industries look after their heavy machinery – potentially saving billions of pounds in the process...

According to a report by Frost and Sullivan in 2015, companies which rely on heavy machinery – including shipping lines and power suppliers – spend over £2 billion a year on oil condition monitoring (OCM). When things go wrong, they spend a further £2 billion on repairs, plus all the other costs associated with downtime. But according to Roy Bitrus, Director of RAB-Microfluidics, the losses are likely to be a lot higher – most companies don’t like to talk about the damage caused by breakdowns because it is such a sore subject.

The stakes are high – and there’s enormous potential for savings. For example, if a key piece of lubricated machinery suddenly goes out of action, oil production may be cut by tens of thousands of barrels a day, or a containership may be delayed for a week or more, not only causing significant financial losses but also reputational damage.

The problem is simple. Whether it’s a ship in the Indian Ocean or a wind turbine in the North Sea, you have to keep a close eye on your machinery, and lube oil analysis is one of the key ways to do that, or else you face the risk of your heavy machinery failing due to wear, contamination or degradation. To try to prevent this, most users of heavy machinery send regular samples of oil for checking in a laboratory, in many cases spending several million pounds a year. The time it takes can also make the problem even worse. If you take the samples once every quarter, for example, you then may wait another two to four weeks to see the results, and this means you may only identify problems long after the machinery has developed a fault or already stopped working.
We also believe that the shift goes beyond temporary cost-cutting measures and that demand is also driven by the need for innovation in the long run.

Traditional solutions are inadequate for critical machines, says Bitrus. Some companies use bench-top “labs” to analyse the oil on site, at a cost of £30–60,000 per device, but these can be too big for most environments. Smaller devices can be retro-fitted, but these are limited in terms of what they analyse, focusing on the physical properties of the oil such as particle counting, viscosity and temperature. In addition, oil sampling is generally done in a hazardous environment, requiring risk assessments and PPE (personal protective equipment), and human error in the sampling can make matters worse, leading to false results.

The solution, says Bitrus, is to automate the process of sampling and analysis of oil, using the “microfluidic lab-on-a-chip” technology developed by his company to monitor conditions in real time, providing both the chemical and physical analysis required for most machinery – in a product which is portable and easy to carry around and install. “Fifteen minutes after the oil is sampled,” says Bitrus, “our solution is already producing results.” In addition, the lab-on-a-chip technology (patent pending) provides continuous data in real time, every day of the year, which should lead to more intelligent analysis as time goes by, getting to know the individual machinery better, thanks to advances in machine learning and Artificial Intelligence.

Traditional solutions can be “reactive and/or preventative,” says Bitrus, and many manufacturers recommend frequent oil changes for certain machines, to keep the mechanical parts lubricated and avoid mechanical failure. By contrast, his company’s lab-on-a-chip can be used as a predictive tool to enable early and timely diagnosis of failure modes – generating accurate, timely reports which speed up the decision-making process and make maintenance more scientific and more cost-efficient, detecting signs of failure in advance and potentially reducing wastage.

The new technology has also been developed at a time when many industries are changing and the need to reduce costs is greater than ever – for example, to ensure offshore vessels can service a dwindling number of oil rigs at a time when production and profits are falling. “We also believe that the shift goes beyond temporary cost-cutting measures,” says Bitrus, “and that demand is also driven by the need for innovation in the long run. That is why small to medium-sized companies like us have greater opportunities than ever to show what we can do, especially in industries like maritime and wind.” The Oil and Gas Technology Centre (OGTC), adds Bitrus, has also helped him and the rest of the team understand the market better and learn how to deal with major players in the industry, “to identify their individual needs, pain points and how our value proposition fits with their business model.”

Bitrus likes to talk about the “holy trinity” of heavy machinery condition-based monitoring – thermography, vibration analysis and OCM. Whilst the first two are already automated and online, RAB-Microfluidics is simply completing the job by developing an automatic, online solution for oil which is also mobile, online and easy to fit.
The business of business

Roy Bitrus was one of the first batch of RSE Unlocking Ambition Enterprise Fellows, so what does he think of the programme so far?

“The Fellowship has helped me understand our business landscape,” says Bitrus, “as well as provide relevant training in business and strategic business principles with practical problem-solving scenarios. The mentorship has also been invaluable, because it helps me understand my role in the company, including my responsibilities as a director. We also learn a lot about finance and raising investment, how to treat our customers and understand our partners. Not everything is black and white in business. There are many shades of grey. We have to understand what our investors are looking for and learn to ask the right questions.”

“We also learn about maintaining our relationships,” he adds, “and how we interact with people in different countries and corporate cultures.

Ultimately, what we do is all about our customers, and delivering a technology that can help guarantee the reliability and availability of their machines, leading to a predictive maintenance future.”

The road to Aberdeen

Bitrus’s entrepreneurial skills first emerged when he was growing up in Nigeria, producing new ID cards for his father’s company when he was only thirteen years old, having noticed that the old cards were deficient. Later on, he started selling laptops in Nigeria and made enough money to help fund his studies, gaining a Degree in Geology and Mining from the University of Jos, before leaving Nigeria to continue his studies and also gain more working experience. Meanwhile, Rotimi Alabi, now the Managing Director of RAB-Microfluidics, had graduated in microbiology at Igbinedion University, Okada, and worked as an analytical chemist for the Nigerian Agency for Food and Drug Administration and Control (NAFDAC), before also heading abroad.

Bitrus and Alabi met at Coventry University in 2010 when both of them were doing their Master’s degrees in Environmental Science. When Alabi moved to Scotland to continue his studies at the University of Aberdeen, Bitrus soon followed and after Alabi completed his PhD, he founded RAB-Microfluidics Ltd, inspired by his research in microfluidics for petroleum products – seeing applications in a wide range of industries where lubricated heavy machinery plays a key role, including oil & gas, aerospace & defence, processing & manufacturing, power generation, transport and shipping.

Although he has already proven himself as a salesman, Bitrus believes that the lab-on-a-chip is the kind of product that will sell itself by delivering rapid results for the customer rather than promising what it can do. Sometimes, however, sales are driven by events that happen after the initial presentation. One new client recently called Bitrus out of the blue, six months after he had first approached the company, and immediately bought into the idea of real-time monitoring proposed by RAB-Microfluidics, after a vessel was significantly delayed due to an engine breakdown – after paying out tens of thousands of pounds for repairs that may not have been needed if the problem had been detected in advance, using the lab-on-a-chip.

RAB-Microfluidics is currently conducting field trials to test and prove the new design, and several companies have already expressed interest in the technology and committed to delivery of the MVP (minimum viable product). This could be a major breakthrough for Bitrus and Alabi, since many companies in the oil and gas sector tend to follow each other when it comes to the adoption of any new technology.

Other breakthroughs have come as a pleasant surprise. Initially, Bitrus and Alabi didn’t think the lubricant companies would be interested in using the product, since it promised to prolong the life of engine oil and thus reduce sales. However, they have since learned that the lubricant companies are keen on the product because they also stand to benefit if they can use it to demonstrate their oil works more efficiently than others, based on real-time data.
When the MVP is launched in 2019, the company will conduct pilot trials with the early adopters, aiming to drive interest across its target industry sectors. “When potential users see the benefits and added value of the product, selling to various industry sectors will be more achievable,” says Bitrus. “Sales will also be business-to-business – it will take a few years to explore the full potential of the product but there will also be a ripple effect in the market as users report its success.”

**Seeking investment**

RAB-Microfluidics was set up in August 2016 and has already attracted significant funding, including grants from Innovate UK and Scottish Enterprise, which helped with proof of concept at the earliest stages, plus support from the Energy Technology Partnership (ETP) and the Oil and Gas Innovation Centre – a total of about £850,000 in grant funding. In early December 2018, RAB-Microfluidics also won an award from Scottish EDGE, following its £60,000 BP Technology Prize. Both Alabi and Bitrus have also been RSE Enterprise Fellows, Bitrus gaining his award under the Unlocking Ambition programme launched by the RSE, the Scottish Government and Scottish Enterprise in mid-2018.

Now that RAB-Microfluidics has started running field trials of its product and talking to potential clients all around the world, the company is actively seeking potential investors, aiming for first-round investment of over £1 million, to take it all the way up to commercialisation – and beyond. Bitrus says they also need to “grow the team,” as well as get ready for full-scale production. Rather than fine-tuning the basic design, however, RAB-Microfluidics will focus on the need to fit the product to individual customer requirements. “We are confident that this first round of investment will lead to sustainable growth,” says Bitrus. “We believe in what we’re doing, and our ultimate objective is to grow to the point where we have the capacity and the resources, as well as the name, to serve companies on a global scale.”

Whether the company becomes a global player on its own or becomes part of a bigger global partnership, Bitrus and Alabi have much to look forward to in the next year as their business matures – even if they have to give their products away to begin with, the proof of their idea will be the orders they receive in the wake of the pilots. Bitrus estimates the value of the market for “automated predictive maintenance technology”, or “smart OCM”, is about £250 million a year in the first phase of growth, but with billions at stake and competitive pressures increasing, this may be the tip of the iceberg.
Ross Mcleod

The crane and lifting industry is worth an estimated $10 billion a year. Without cranes, many industries would struggle to function, including shipping, oil & gas and construction, and a start-up in Aberdeen currently hosted by the Oil & Gas Technology Centre is after a slice of this fast-growing market by making cranes operate smarter and faster...

Ross Mcleod has witnessed the death of a colleague, crushed by a container on an oil rig off Angola, but that is only partly why he's set up his business, developing a stream of innovative wireless solutions for the crane and lifting industry. Safety and security will always be priorities – for example, preventing collisions – but improved productivity and a reduction in downtime could add a lot of value to the industry, and that's the proposition that Mcleod will be selling to customers later this year, as he launches his first range of products.

Mcleod’s new venture, Intebloc Ltd, prides itself on being a company “founded on innovation through experience,” and some of that experience was gained in highly dangerous conditions. As well as seeing someone killed while working in West Africa, Mcleod has also escaped from a fire on an oil rig, and observed first-hand the panic that can lead to even greater loss of life, as people searched for lifeboats or simply jumped into the sea because communications broke down in the midst of the chaos. Add to that collisions and equipment failures, plus inefficient use of resources, and Mcleod believes that his intelligent solutions will not only save lives but money – in some cases, millions of dollars a day.

“Cranes and lifting are two of the main elements of the supply chain, and our vision is that our solutions will increase productivity and safety – eradicating accidents, reducing costs and also cutting hydrocarbon footprint,” says Mcleod.
Sometime, it can take 45 minutes to offload a single container, and when you have 30 containers to shift, and a storm is approaching, every minute is precious.

McLeod got his first job in the oil and gas industry at 18 years old, initially as a trainee sales manager at Arco, then spent the next nine years in offshore inspection, working for Sparrows Servtech, focusing on issues such as safety and compliance with industry standards. Next, he worked with Load Systems International, now part of Trimble’s lifting solutions division, specialising in wireless crane and lifting instrumentation.

Two years ago, having travelled all over the world, working in West Africa, the USA and Asia, as well as the North Sea and various countries in Europe, McLeod decided to set up his own firm, specialising in wireless solutions for the crane and lifting industry, drawing on his own experience – and seeing a significant gap in the market. He could see the benefits of existing wireless crane and lifting solutions, but he also believed there was scope for improvement, especially in cameras and operational software designed to enable much better control of the cranes, as well as more efficient platform management.

McLeod has seen for himself the kind of problems faced by operators. Accidents and equipment failures can make a critical difference, especially offshore where replacement parts may take several days to arrive. Sometimes, it can take 45 minutes to offload a single container, and when you have 30 containers to shift, and a storm is approaching, every minute is precious.

Product pipeline

The first product in the company’s pipeline (due for launch in April 2019) is a tablet-based software solution called Rig-Ware, designed to keep track of the different equipment on platforms, and minimise the damaging impact of DROPS (objects/tools that fall from heights). At any one time, there could be 1,500 different assets on deck, and according to McLeod, DROPS are usually the major cause of “loss-time incidents (LTIs),” leading to significant problems when equipment breaks down or goes missing. “Rig-Ware is challenging the most common LTI within the industry,” says McLeod. “Between 2017 and 2018, DROPS were responsible for 59 LTIs in the UK alone, and an additional seven recorded lifting failures. This doesn’t include near misses or non-recorded accidents, so in reality the number will be a lot higher.” Every item on deck also has to be certified every few weeks, so having an intelligent deck management or “stock control” system such as Rig-Ware would also help speed up these regular surveys.

Another new intelligent technology on the horizon is a camera called Inte-View, which attaches to the crane block, extending the reach from the tip of the boom so the crane operator can see into spaces where he’d normally need an assistant to look out for problems – for example, blind spots on the deck or deep inside hatches. McLeod describes this as an “extra pair of eyes” for the crane operator, and expects to have the new product ready for market by August this year.

McLeod is also building a solution for lifting containers called Lift-Scan, so operators know exactly what to do with their cargo as soon as they scan it, using deck management software which identifies the optimum location for every individual container and piece of equipment, then stores the relevant data. “This alone could improve productivity by something in the region of 30%,” says McLeod, “by rationalising the use of the deck space and speeding up the lifting process.”
Another major area where Intebloc sees opportunities for high-tech solutions is personnel tracking systems – enabling managers to see where people are in real time, at the same time as alerting personnel to any imminent danger such as moving containers. In the event of an accident, when people need to evacuate, tracking systems could also help organise people, making sure they get into lifeboats, for instance. In combination with the new generation of cameras, Mcleod suggests the fatal accident he witnessed several years ago might never have happened – the crane operator would now be able to see there was someone in danger and the victim would also receive an alarm. His solution, called C-Trac, is scheduled to be on the market towards the end of 2019.

Investment so far

As well as winning an RSE Unlocking Ambition Fellowship in 2018 and being part of Scottish Enterprise’s High-Growth Programme for start-ups, Mcleod has won funding worth £100,000 from the TechX programme, managed by the Oil & Gas Technology Centre, plus £40,000 as one of the two “game-changing technology companies” selected by BP Ventures. The money will allow Mcleod to carry on development and provide him with business support. He is also planning to recruit a Chief Technology Officer and a Chief Financial Officer later this year, and has already identified the candidates he wants to bring on board.

Last December, Mcleod “nailed down the numbers” for his business plan, in preparation for a serious fundraising exercise later this year, so he can build his team and bring more new products on stream. There’s still a lot of work to do before the company becomes an established “world leader”, but the product launch this summer will hopefully give Intebloc a foothold in a major global industry – and a platform for growth.
The losses are spectacular – and so are the maintenance costs. Every year, the UK north sea oil and gas industry loses nearly $5 billion because of leaks, and spends a fortune checking pipes (including small bore tubing) on rigs where the leaks are most likely to happen. But what if you could speed up inspection, reduce costs and prevent leaks before they occur? David Phin of Paragon Inspection thinks he has the answer...

He may not be Superman, but David Phin, the CEO of Paragon Inspection, may be able to prevent environmental and financial disaster by using X-ray vision to inspect the pipes on oil rigs. His solution could also reduce the time it takes for an inspection from several hours to a matter of seconds, without the need to go through a total of 50 procedures, including shutting down production, isolating and purging the system, disassembly, visual inspection, reassembly and pressure tests – saving companies hundreds of millions of dollars a year and slashing the number of people required.

Every year in the North Sea alone, over 12 million barrels of oil are lost due to leaks from small bore tubing (SBT), costing the industry nearly $1 billion. In the North Sea, there are 186 oil and gas assets, out of a total of over 1,300 worldwide, and global losses from SBT leaks are now approaching $7 billion a year. With 150,000 connectors on each rig, it's no surprise that accidents will happen, and many leaks are caused by human error when assembling the pipes.

“There are 13 different ways to wrongly connect them and only one way to do it right,” Phin explains. And when something goes wrong, it can go very wrong – millions of dollars per day can be lost due to shutdowns and it can take days to find the leak, fix the system and restart production.

The SBTs themselves may be perfectly sound when they land on the platform but when they are assembled, there is always potential for error – industry estimates suggest that up to 26% of assemblies are not done correctly. Other causes of “integrity failure” are vibration fatigue, as well as poor inspection and maintenance programmes. In addition, because the SBTs must be randomly inspected on a regular basis to meet health and safety requirements, new problems may be created if they're reassembled incorrectly. Offshore inspection costs can also be a drain on resources, due to a lack of economical solutions and trained personnel: “It costs 19 times as much to send people offshore,” says Phin, “compared to having the inspection technology and trained people there on the spot all the time.”
According to Phin, SBT assemblies have been a problem since they were first introduced over 30 years ago. “There is no means of verification,” he says, “and the industry now recognises the scale of the problem.” Over the last three years, 5,000 people have been trained to work with SBT. “But they don’t have the right tools for assembly and checking,” adds Phin, “and inspection costs in the UK alone can be as high as £400,000 a year per asset.” And that’s why Phin believes his new inspection solution is a “no brainer” product that may become industry standard.

The Paragon solution
Phin’s new solution is a digital inspection technology called OLEG™ (on-site low energy gauging), designed to transform the inspection of small bore tubing by reducing hydrocarbon leaks and “associated human factors,” thus reducing risk and downtime and increasing reliability by detecting problems before leaks occur. As well as making it easy to check the assemblies, the system guides the user through the process by uploading information to a database, and not only assesses the current integrity of SBTs but also predicts future problems.

The OLEG system consists of two different tools – an integrity assessment tool scheduled for launch in July 2019 and a handheld X-ray tool which should reach the market in early 2020. The X-ray tool is patented in the UK and both tools have various international patents pending.

As well as checking connections to see if they are tightened correctly (if they’re too tight, they may crack, and if they’re too loose, they may leak) and checking for correct internal fitment, the future OLEG system tools will be readable by a mobile app, uploading data to a database and thus reducing inspection time by 50%.

The new X-ray tool can check the internal integrity of the connectors without pulling the tubing apart, and without all the safety procedures required by conventional X-rays – the low energy used is contained inside a compact handheld device. In addition, the results of the scan can be seen in a matter of seconds, without the need to process any film and interpret the images. All you need to do is pull the trigger and the scan is complete.
“Our solution makes it possible to verify the integrity of SBTs and rate the competency of assembly,” says Phin. “We also plan to offer a solution for follow-on system visibility, rating competency and recording the data relating to all SBT assemblies throughout their life-cycle, including who did what, when and where.” The system is also designed to manage the risks related to legacy assemblies, as well as risk and predictive analysis for new installations.

The fitting assessment tool will be piloted later this year. “The next step is to find a partner and start field trials to refine the design and further prove reliability,” says Phin. In the initial stages, Phin will send out his own operators, who will not only be ambassadors for Paragon but will also provide him with valuable feedback on how the solution is working and how to improve it. Phin says more development is needed before the new scanner is ready for market. It has passed the proof-of-concept stage, but the prototype still requires additional testing, as well as industry approval.

**The road to investment**

Paragon Inspection was one of the first companies to be selected for the TechX Pioneers Programme set up by the Oil & Gas Technology Centre in Aberdeen, competing with 120 ideas from 24 countries. The programme is designed to accelerate innovation in the oil and gas industry, and this included funding of £100,000, plus mentoring and business training.

Phin was also chosen last year for an RSE Unlocking Ambition Fellowship, which brought in a further £45,000, as well as “expert support and guidance” through the Entrepreneur Business School training programme – how to raise investment, build a team and progress from start-up to scale-up. As a result, Phin is busy putting the finishing touches to his business plan and starting to look for investors.

**Disruptive technology**

Interest in the product may come from the fact that it is a disruptive technology which solves a long-standing industry problem. According to Phin, the other factors driving demand will be an increase in regulatory compliance regarding safety and environmental protection in different end-user industries and an increase in industrial process complexity. “The risk associated with it is also increasing,” he explains, “while new health and safety requirements could also drive demand, especially if the relevant authorities adopt the solution as an industry standard practice.” Currently, only about 10% of SBTs are randomly disassembled and inspected every year, but Phin believes his new solution could make a huge difference.

“We are developing a smart, disruptive, patented technology,” Phin declares, “with a vast global market. That’s why I am confident our early investors will see a massive return on their money three to five years from now.”

When Phin was a consultant, he used to think, “If there’s no problem, I don’t have a job.” Nowadays, as he develops the products and builds up his business, his perspective has changed. “I’m on a journey now,” he says, “taking my ideas to the next level, building the business and building the team, and changing the way things are done in the industry. That’s my job now.”
Digital technology is becoming increasingly important in healthcare, not just for diagnosis but also for connecting people with available resources – and each other. Edinburgh-based CogniHealth is showing what is possible by developing a “digital companion” called CogniCare for helping people with dementia and their carers, which could be the start of a new type of app to help with many other neurological, psychological and psychiatric conditions...

When you work as a professional carer with people with dementia and their families, you get to learn a lot about this life-changing condition and its impact on the people affected. But not many carers go on to develop an app which promises to “transform dementia care,” and build a new business to market the app.

Hosted by the University of Edinburgh and Edinburgh Innovations, Pooja Jain was not only inspired by her own academic research to develop the CogniCare app, but has also been able to draw on her personal experience as a professional carer. She says she has “a passion for human cognition” and has studied the impact of memory loss, but she has also seen the impact of dementia face to face.

Jain came to Scotland in 2011 to do a Bachelor’s Degree in Biomedical Sciences, followed by a Master’s Degree in Neuroscience by Research at the University of Edinburgh. Her research interests focused on “cognitive characteristics and interventions for neurological disorders,” including lab-based research into various aspects of Alzheimer’s disease – an interest that now drives her business.

How it all started
The “eureka moment” for Jain was at a neuroscience conference in 2016, when she had a conversation with a man about his personal experience of “living with dementia,” caring for his wife. “Until then, my interest was more academic,” says Jain, “but listening to this man, I could see how dementia impacted people and families in real life, and the difficulties carers were facing – how time-consuming and frustrating it could be. I also realised that dementia is an area of huge unmet need.”
Technology will never replace human beings when it comes to the everyday problems of care, but it can be an enabler.

After graduating with her Master’s Degree in 2016, Jain returned to India to spend a few months with her family and make plans for her future in Scotland. It was during her visit she started to think about the conversation at the conference and discuss the possibility of using technology to help with dementia care, sharing her ideas with her father Sunil, the Director of Software Engineering at Cisco Systems, based in Bangalore. “My father has a lot of experience in using technology in education and healthcare, and we both agreed that even though technology can be transformative in many different industries and applications, healthcare – and even more so social care – has been somewhat left behind,” says Jain. At this point, Jain made a decision: rather than go on to do a doctorate in Edinburgh, she would develop a solution that could have a real impact on people affected by dementia.

As soon as she came back to Scotland, Jain took a part-time job as a professional carer, and experienced first-hand the issues involved. “I learned a lot about the family dynamics, and out of that experience, CogniCare and the business were born,” she explains.

According to Jain, the key challenges for people with dementia and their carers, aside from the initial diagnosis and ongoing medical treatment, are “what to do, where to go and whom to trust. Technology will never replace human beings when it comes to the everyday problems of care, but it can be an enabler”, says Jain.

As Jain started doing research into digital healthcare solutions, a pattern began to emerge. “There were lots of apps aimed at people with dementia,” says Jain, “but there was nothing that could address the needs of both the person with dementia and their carer, or help with the day-to-day real-life problems faced by many families and carers.”

Many people give up their jobs to look after family members with dementia, and the majority of carers tend to be above average age – people in the 40–65 age range looking after their parents. This encouraged Jain to develop a solution that is not only easy to use, even for people not used to technology, but also tailored to the individual needs of people with dementia and their carers. “Nothing else in the market provides the holistic and personalised support carers need,” says Jain.

The solution emerges

The result of this research is a new app called CogniCare, designed “to improve the quality of lives of those affected by dementia,” by personalised support and helping people to connect with their community, as well as access care information “anytime, anywhere.”

According to Jain, every person with dementia has a unique journey, facing different symptoms that progress at different paces. For example, as dementia progresses, the demands on the carer increase and can be frustrating and stressful. Many carers don’t receive the support they require to understand the symptoms, why it’s happening and what can be done, leading to misunderstandings and accidents that could have been avoided if the carers had known.
The CogniCare app is designed to help carers understand the symptoms by adopting a four-step approach to identify, understand and respond to common symptoms – e.g., aggression, repetitive questions, anxiety, lethargy or inappropriate behaviour – and evaluate different interventions. It also helps identify what triggered the behaviour, to help understand why it happened and address the behaviour – e.g., people with dementia may not be able to communicate their needs, such as hunger or thirst, or may have a low stress threshold, including being sensitive to changes in environment or irritants such as noise. New medicines or alterations in dosage can also cause a change in behaviour, and as the disease progresses, there are pathological changes in the brain which can alter behaviour. Different interventions are suggested by the app, such as music or exercise, as well as medication and environmental cues – e.g., de-cluttering, changing the lighting or looking at photos. Finally, CogniCare helps to evaluate the impact of these different interventions, helping carers note down the effects for future reference, or suggesting a different approach.

To make the app easy to use, it takes advantage of Alexa, the virtual assistant developed by Amazon now used by millions of people worldwide for everything for switching on alarms to looking after people with dementia. Although it’s not designed for diagnosis, the app is used to monitor changes in symptoms and help carers cope. It also provides links to local resources such as Dementia cafés, suggesting local walking groups and other social events which increase social capital (the value of people’s connections). “It’s important to keep the brain engaged,” says Jain, “through physical and mental activities, and bringing people together.”

The CogniHealth team
Jain is now supported by a highly qualified and well-connected team of advisors. The core team – Jain and her co-founders Giulia Melchiorre and Pranav Chauhan – is backed up by Professor Craig Ritchie (Professor of the Psychiatry of Ageing at the University of Edinburgh), Richard Lewis (Business Consultant), Albert Nicholl (a senior business leader in the Life Sciences and MedTech sector) and Jain’s father Sunil Jain (Director of Software Engineering at Cisco Systems in India).
Sunil advises the team, based in Bangalore, whilst Pooja and her core team work closely with families, healthcare specialists, academics and organisations, such as Alzheimer Scotland, to develop the business in Scotland. “This is a structure that works very well,” says Jain, “even though we are thousands of miles away from each other.”

The company is keen to make a difference in healthcare, declaring on its website: “People with dementia and carers are at the heart of everything we do. We believe that an insightful understanding of dementia can help create a world where people are free from the fear and heartbreak it brings. Taking care of someone with dementia is not an easy task, and there are many different aspects that need to be considered.”

**Early-stage investment**

Setting up the business was a totally new experience for Jain and her co-founders – Melchiorre graduated with an MSc in Neuroscience by Research the same year as Jain, whilst Chauhan graduated with an MA (Hons) in Economics and Finance. “Since starting out, I’ve been exposed to lots of things I’ve never done before, like the legal, financial and marketing aspects of business,” says Jain. “Initially, the only thing I thought about was having an impact on people, but now I am running a business. And every day, I have to learn something new.”

Jain got a major boost when Alzheimer Scotland took an interest in what she was doing, soon after the company was set up in April 2018. While she was doing a presentation at Alzheimer Scotland, the Chief Executive, Henry Simmons, passed by and told Jain her solution could be a good fit with Alzheimer Scotland’s new digital strategy. And to back this up, Alzheimer Scotland provided both financial and sector-specific support. Last year, Jain also won an RSE Unlocking Ambition Fellowship worth £50,000, to fund her for a year and provide her with training.

Since then, Jain and her team have been busy improving the app, and building the business. The next step will be to raise seed-round investment, most of which will be spent on a marketing drive.

So what is the size of the market? “There are 700,000 carers in the UK alone,” says Jain, “and an estimated 850,000 people with dementia. The potential is huge.”

As CogniHealth establishes its presence in the market and reaches out to more and more affected families, Jain is already thinking a few years ahead. Dementia will be the main priority for now, but mental health in general (e.g., depression and anxiety) is a similar issue for the people affected, requiring the same level of intelligent support. “Dementia will always be a major global problem,” she says, “but now we are looking beyond.”
Usman Yaseen

Digital piggy bank helps kids get savvy with money

His business advisors told Usman Yaseen that it would be a bumpy journey, and they were right. But the 38-year-old from Clydebank believes he is now on the road to success with a best-selling platform for children – a digital piggy bank that teaches kids the value of money and allows them to purchase their own toys online...

The experts always say that you should understand market requirements and listen to customer feedback, and Usman Yaseen’s customers have been at the heart of his business from the very beginning – his nieces and nephews inspired his new app.

“One day, they asked to borrow my credit card,” Yaseen explains, “so they could buy some toys online, and that’s when I got the idea. I wanted them to understand the value of money but also have fun at the same time as actually shopping for real – with their own money rather than mine!”

Yaseen then started researching the market and discovered there was no app on the market at the time which did all the things that he wanted, so decided to build it himself. A lot of major companies, especially toy stores, aimed their end products at children but their websites were designed for use by adults. There were also lots of purely educational platforms, but Usman didn’t rate them in terms of engagement and saw that “there was no toy at the end of the experience – or any fun.”

At this point, Usman set out to develop “the Number One pocket-money fintech app in the world,” and the result is Sonik Pocket – a free mobile app that helps parents teach their children the value of money and purchase items online from participating stores who pay Sonik Pocket commission on sales.

To make the app appealing to parents and children, Yaseen designed it to be fun to use as well as educational, using gamification to help children learn at the same time as buy things. Among the topics covered are the basics of how people earn money, save it and spend it, which is linked to children earning pocket money by doing their homework and helping with housework, then saving up to buy their favourite toys. When they reach the checkout in the internal toy store, the children are then asked to do simple sums, based on how much they are spending, to learn how to budget and develop their maths skills. Parents also get involved by setting simple tasks for their children to earn themselves money, so the children learn about motivation and discipline – and get rewards. As well as providing safe access to toy stores and helping them manage their saving accounts, the app also lets children build their own wish lists and even compete with their friends.
“Our vision is to create the future generation of financially literate children, combining traditional teaching methods with 21st-Century technology,” states the Sonik Pocket website, which also tells the story of a “super-galactic family of robots who have come to Planet Earth to help save your children from the perils of bad maths and the complicated dangers of online shopping,” to make the experience feel like the kind of game children will play.

Yaseen also knows many parents are concerned about their children spending too much of their time on their own playing games without any practical or educational value: “We won’t disrupt the market, but we will appeal to parents who are keen to teach their children the value of money and want them to experience the real world of shopping online in a safe environment.”

Yaseen has already signed up two retailers in Scotland and one leading toy store in England to test-drive the app and wants to prove that his idea will work before approaching larger stores, building a case study – and credibility – for his new app, before rolling it out into Europe.

Before then, Yaseen knows he has to focus on delivering concrete results: “You can’t just be a visionary. You only get one chance to prove you are onto a winner, and you need something tangible first.”

The journey so far

When Yaseen first came up with the idea in 2016, he didn’t know how to create an app or understand all the legal requirements – never mind set up a business and talk to potential investors. It was a promising concept but what about monetisation? What about providing it on different platforms such as Android and iPhone?

The Royal Bank of Scotland Accelerator Programme gave Yaseen a huge boost in the early days, providing him with business and technology advice and setting him off on his journey – including simple things such as learning how to make presentations.

When he was accepted into the RSE Unlocking Ambition Fellowship programme in 2018, his business education gathered further momentum, focusing on how to build his team and raise investment, as well as commercialisation and networking skills.

“Being part of the RSE programme is a massive coup for me,” says Yaseen. “When I applied, I thought that only academics would succeed, but clearly that isn’t the case.”

When Yaseen left Clydebank High School, he had no plans to go to university or college. “Traditional methods of learning don’t work for everyone,” Yaseen explains. He then learned the basics of business and customer service by working in a British Telecom call centre, followed by a similar job at T-Mobile (now EE Mobile), working in sales and user support – “learning how to deal with people.” For the next seven years, he worked in a Soft Play centre in Glasgow, and this in turn provided good experience working with children. To supplement his earnings in the early days of Sonik Pocket, Yaseen also worked as a consultant for several technology companies.

Is Yaseen an entrepreneur, an engineer or an inventor?

“I can’t build a website from scratch, but I’m building a business around a new app,” he explains. “A big part of my job is learning how to join the dots and build my personal network, sharing the vision and building the team.”

At the moment, there are four people in Sonik Pocket including Yaseen (CEO), the CTO Jamie Balish, who co-founded the company three years ago, Paul Blackler (Business Development) and Ross Thompson (Education Development). The next person coming aboard will focus on increasing the company’s social media presence.
Seeking investment

Yaseen is now preparing for his first round of investment, looking to raise £250,000 this year. He has also considered crowdfunding as an alternative. Meanwhile, the development process continues, engaging with parents and gathering feedback from children to validate what he is doing and improve the product design.

“We want to teach kids about finance the fun way, but we don’t want to make money seem like a burden, or even make it feel like education when they’re using the app,” says Yaseen. “We already have a good idea what users want, so now we only need the credibility that comes from success.”

So far, Sonik Pocket has been well received in Scotland, winning two awards from Scottish EDGE, Opportunity Knocks and an Entrepreneurial Spark award (now The Royal Bank of Scotland Accelerator Programme).

Other companies with similar “digital piggy bank” products have already entered the market, including goHenry, with its pre-paid, pocket money card and app designed for children, which reportedly has 80,000 users and attracted more than £6 million from investors via Crowdcube, including many customers. In Yaseen’s view, his main competitors are not as strong in terms of education, focusing more on providing a platform for spending your money, or teaching kids without being able to buy things. Other platforms also tend to earn their money via customer subscriptions – for example, goHenry charges £2.99 per month per child. In contrast, Sonik Pocket will continue to earn its commission from sales and provide the app free to subscribers.

“We have had exploratory talks with a few major industry players,” says Yaseen, “but first we want to focus on developing the app and our partnership with the three toy stores, gathering feedback from users and proving the value of what we are doing.”

Sonik Pocket has also been gathering data in surveys, which reveal that parents don’t know how to talk to their children about money matters in general – data which could prove extremely valuable in future projects.

According to Yaseen, several banks have expressed interest in Sonik Pocket, but he would prefer to remain independent. “I want to be in control of my own destiny,” he says. “It may be a bumpy journey, but it’s worth it. This is a project very close to my heart and I want to send out the right message to parents and children – including my nieces and nephews.”
Making waves in drug delivery

From paintball guns and fuel-injection engines to nebulisers and inhalers may seem like a big step to make, but Elijah Nazarzadeh likes a challenge and is currently leading the commercialisation of an innovative drug-delivery solution which he believes will not only benefit patients by increasing treatment efficiency and lowering costs but also enable pharmaceutical companies to deliver a new generation of drugs...

The science may be complex, but Elijah Nazarzadeh has a simple objective in his latest business venture. Using a new technology which takes advantage of surface acoustic waves (SAWs) to deliver drugs to sufferers from lung disease could have a major impact on millions of patients all over the world, and Nazarzadeh is determined to turn this vision into a reality.

“The burden of respiratory diseases is huge,” he says, “and I want to see more people get global access to treatments that improve their quality of life, by making drug delivery solutions more affordable and more efficient.”

The new technology, called Acu-Flow (see sidebar), offers several advantages over existing devices to deliver drugs to the lungs, including lower-costs, but the major benefit is the ability to control the dispersion and size of the aerosol droplets and therefore “increase their delivery efficiency.” Droplets sized from one to five micrometers can deliver drugs deep inside the lungs, but larger droplets can get stuck in the mouth and throat, whilst smaller ones may be exhaled before they have the chance to be absorbed in the lung.

“We had an initial idea of what the technology could achieve but we wanted to understand the problems faced by the industry, including clinicians, nurses and patients, and discover if there’s a market for our kind of product,” Nazarzadeh explains. “Current methods tend to be inefficient and expensive (nebulisers can cost up to £600 per unit), and many nebulisers and inhalers only deliver a small percentage of the drug to the patient, in many cases as little as 30%. This can lead to significant wastage and also restrict the use of more expensive pharmaceuticals.”

Many patients struggle to use nebulisers at home, while some models can also be too big or awkward to carry around. Maintenance can also be a burden, Nazarzadeh suggests. For example, a patient with cystic fibrosis may need to take three different drugs every day, using nebulisers for 15–20 minutes, up to six times a day – then spend another 15–20 minutes cleaning the nozzle in between treatments. This is not just time-consuming, he adds, but can also be stressful.

Sounding out the market

While the technology continues to evolve, one of the most important aspects of development is engaging with clinicians and pharmaceutical companies, to understand what they need and how the product may be able to help them. The market research carried out by Nazarzadeh has been partly funded by Innovate UK and has been a major influence on Acu-Flow.

About Acu-Flow

Acu-Flow – a spin-out company developing a novel pulmonary drug-delivery technology which enables precision therapeutics for established drugs and future gene therapy treatments.
Lung diseases: the challenge

- In the UK, someone dies of lung disease every five minutes – about 115,000 people every year, including 30,000 deaths from COPD (chronic obstructive pulmonary disease), 1,200 deaths from asthma and 100 deaths from cystic fibrosis. Together, this accounts for about 20% of all deaths.

- Approximately one in five people in the UK has suffered from asthma, COPD or another long-term respiratory illness, and half of them are currently receiving treatment – mainly via inhalers. About eight million people in the UK have been diagnosed with asthma and 1.2 million with COPD.

- Inhalation is the most efficient non-invasive way of delivering drugs to the body. When the droplets reach the lungs, there are fewer undesired side effects and the drug goes direct to the infected local area. The effectiveness of inhalation is largely dependent on the size and distribution of the droplets.

- Nebulisers work by creating a mist (e.g., using air compressors) of drug particles (e.g., bronchodilators, steroids and antibiotics) that patients inhale via a face mask or mouthpiece.

In addition, many pharmaceutical companies say they’re unable to deliver new drugs, including “very fragile biologies,” because existing nebulisers aren’t up to the job. With personalised medicine becoming increasingly common, many gene-based therapies will also require new drug-delivery solutions, customised for the particular drug.

Acu-Flow, says Nazarzadeh, offers “global access” for patients with respiratory disorders. It is also a low-maintenance, low-power, low-cost solution which is portable and easy to clean, and some of the components are “simple disposables.” But the unique selling point, he stresses, is the ability to control the size of the droplets. Some competitive products offer similar advantages, including low power, but critically they can’t control the size of the droplets – and that is precisely where Acu-Flow still has the edge.

“Improvements in inhalation technology would make a huge difference to millions of people,” says Nazarzadeh. “And Acu-Flow could also deliver the next generation of drugs.”

Seeking investment

The research team behind Acu-Flow is initially looking to raise seed funding to develop the technology and demonstrate the product. They currently have translational funding from the medical and engineering research councils to generate clinical data. One aim is to show that existing formulations that currently can’t be delivered efficiently using existing devices can be delivered better using Acu-Flow. In partnership with several pharmaceutical companies, they also plan to carry out a series of trials to generate the data for new drugs coming into the new drugs discovery pipeline.

“Collaboration with partners in the pharmaceutical industry is critical, as we need to co-develop the product and tap their specialist knowledge,” Nazarzadeh explains. The trials could also mean that new drugs will come onto the market which otherwise may have been left on the shelf.

Next year, Acu-Flow will try to raise further funding to commercialise the product and bring it to market, which should take another three years. A total of five years may seem like a long time to wait, but most investors will confirm that this is needed to develop, regulate and commercialise an innovative healthcare solution. Investors and industry partners will drive the business forward in the short term, but other drug delivery product suppliers may also help – and this may boost the profile of the company and also enable an exit for early investors.

For Nazarzadeh, however, the focus for now is on getting the product to market and seeing it benefit patients.
Nazarzadeh has also done a lot of market research on surface acoustic waves nebulisation and last year he won an Innovation to Commercialisation of University Research (ICURe) grant “to explore the commercial potential of the new technology.”

As an RSE Unlocking Ambition Fellow since July 2018, Nazarzadeh now also has the opportunity to sharpen his entrepreneurial skills, learning from some of the most experienced business people in the UK: “The Fellowship provides an opportunity to deliver a sustainable business plan – and change many people’s lives all around the world.”

“For the last year, I’ve been talking to potential investors and partners,” says Nazarzadeh, “to identify their requirements and develop our business plan accordingly. I thought I knew it all after a couple of months, but as time goes by, I realise how much I still have to learn, as the business evolves.”

Does Nazarzadeh see himself as CEO or CTO of the new company? “I would be happy in either role,” he answers. “As the business becomes more established, different skills will be needed and more people will join us, but no matter how the company grows in the future, I just want to make sure it happens.”

Every time Nazarzadeh goes back to work in the research lab, he soon finds that he’s itching to get back to business. “To deliver what I started is my passion,” he says. “Acu-Flow is not just a challenge in terms of the science, but also a challenge in terms of the business, learning something new all the time.”

For Nazarzadeh, the challenge ahead will be all about bringing the product to market and making sure the business is successful, and this will also satisfy his altruistic instincts – if the business prospers, then patients will get better treatments. “I just want to see people benefit from our product,” he says, “and by combining our new technology with gene therapy and other novel drugs, then we can also help to shape the future of medicine.”

How Acu-Flow works

The research team behind Acu-Flow has developed a new technique of aerosolisation using surface acoustic waves (SAWs) combined with special filters which control droplet size and dispersion – and thus improve delivery of many pharmaceuticals.

SAWs are similar to seismic activity or the waves of an earthquake, but at the scale of nanometers (~10,000th of the width of one human hair). Acu-Flow uses an electric pulse to generate vibrations as sound waves along the surface of a solid material, which then transfer into the liquid on its path, forming ripples in the liquid. The size of the droplets in the mist generated is controlled by confining the ripples (or capillary waves) in cylindrical cavities or microfilters, in the order of 100s of micrometers (µm), producing droplets with diameters as small as 1–5 micrometers (µm). These droplets tend to lead to better penetration and dispersion in the pulmonary cavities than larger ones.
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